

# Experimental characterisation of bentonite hydromechanical behaviour in high salinity environment



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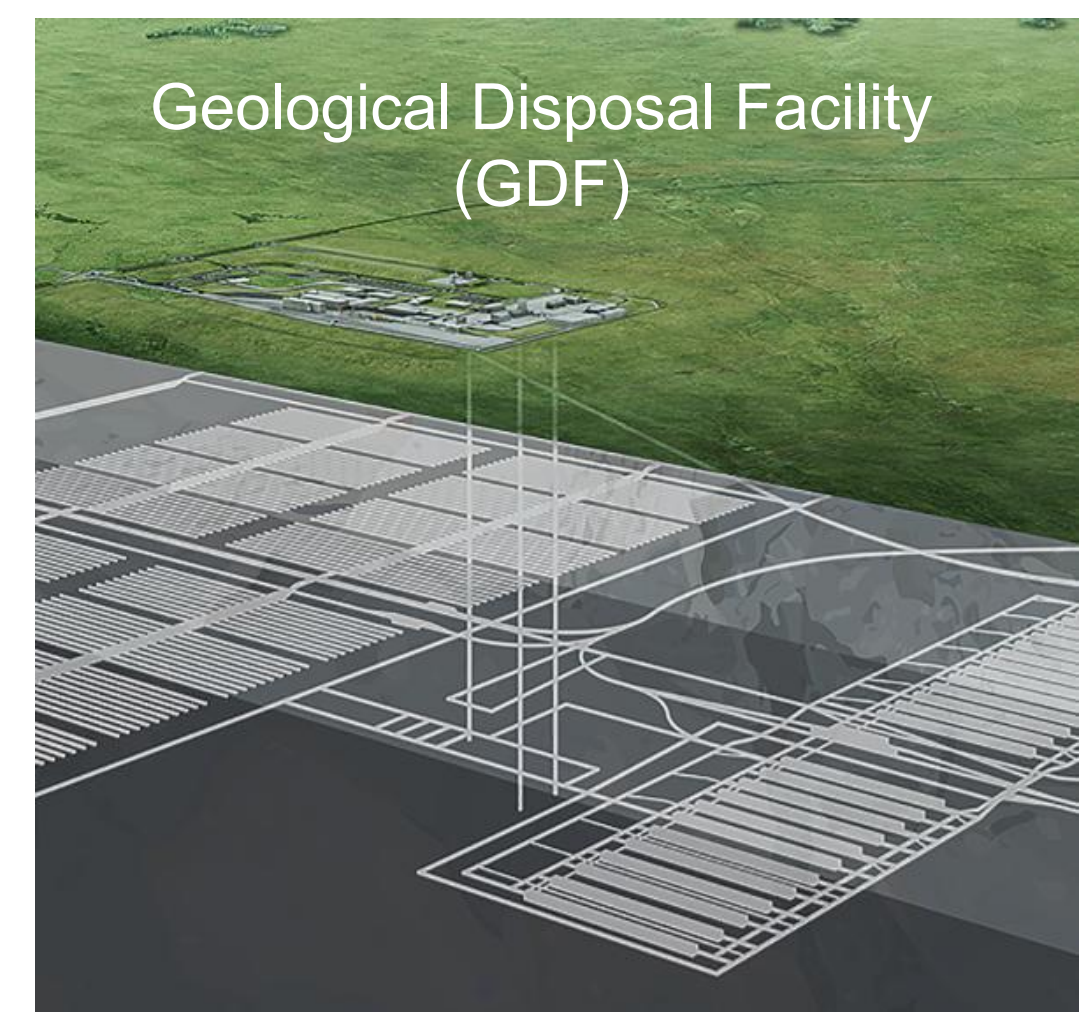
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## 1. Research Context & Research Question

### 1.1. Research Context

- Bentonite is widely considered a suitable buffer/ backfill material for the Geological Disposal Facility (GDF).
- In contrast to GDF designs in most other countries (with Canada being the exception), the UK concept accounts for the presence of groundwater with high salt concentrations, attributed to the evaporite-rich host rock.



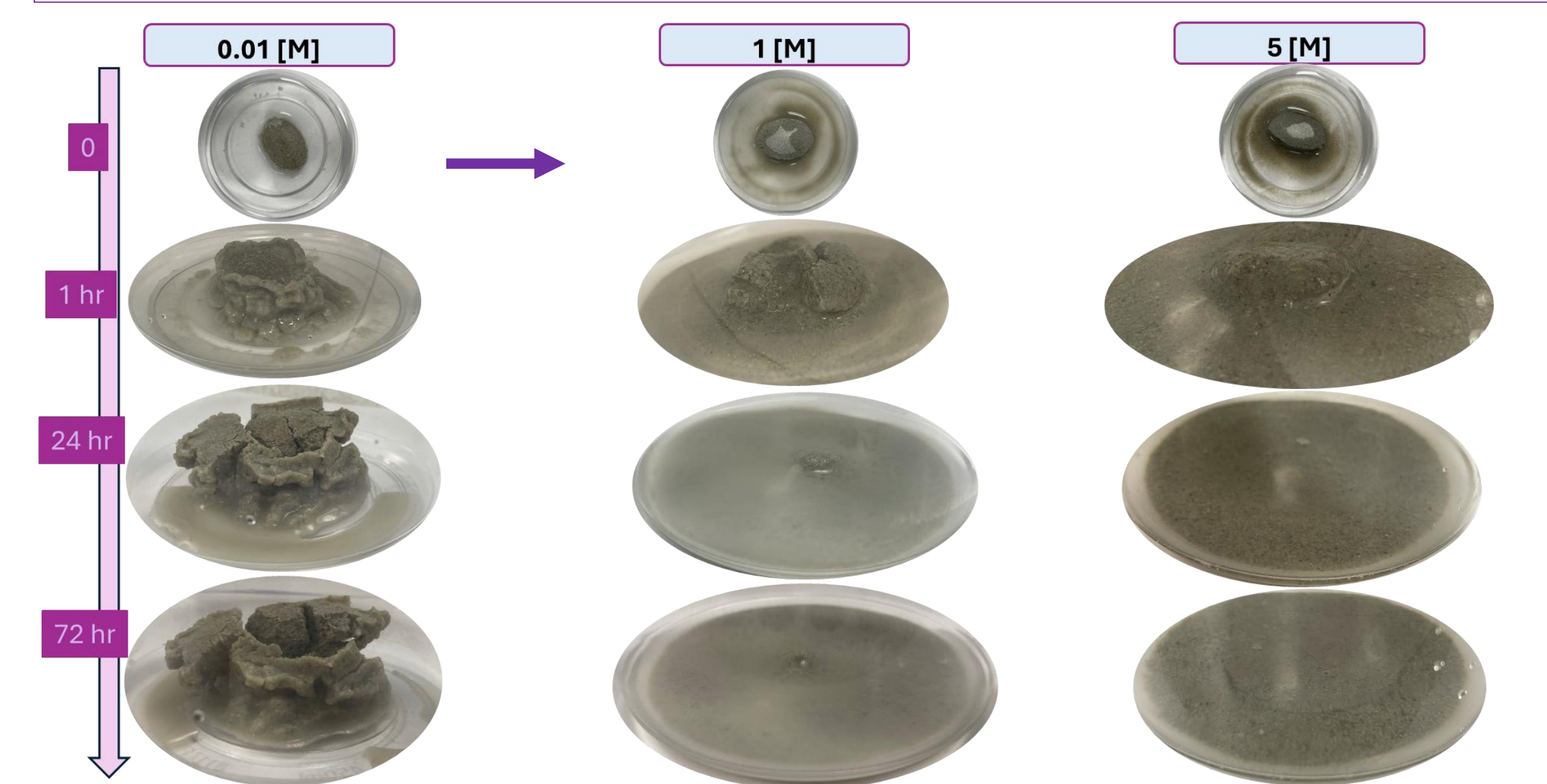
Solid radioactive waste is securely packaged within engineered metal or concrete containers (Engineered Barriers System, EBS), placed deep underground in stable host rock, and surrounded by protective layers of clay.



Bentonite is used in GDFs as part of the Engineered Barrier System (EBS).

- Properties:**
- High swelling potential
  - Low permeability
- Advantages:**
- High sealing capacity
  - Reducing radionuclide migration
  - Reducing corrosion
  - Microbial inhibition

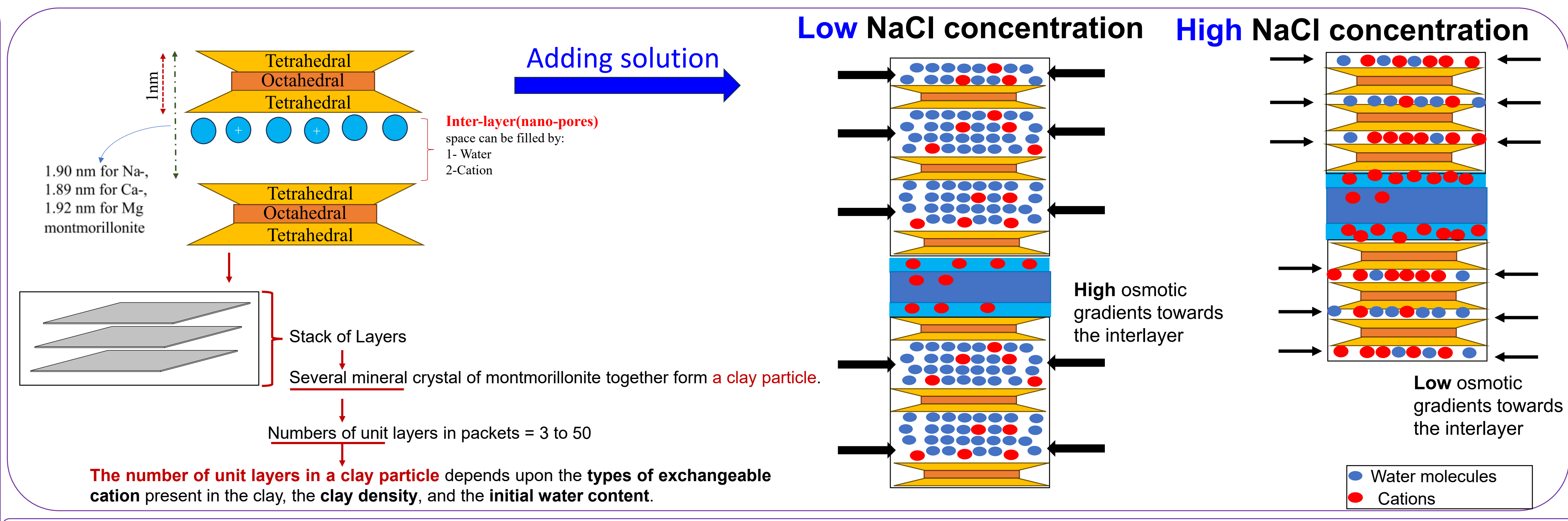
**The Issue:**  
Bentonite has limited swelling capacity in saline environment.



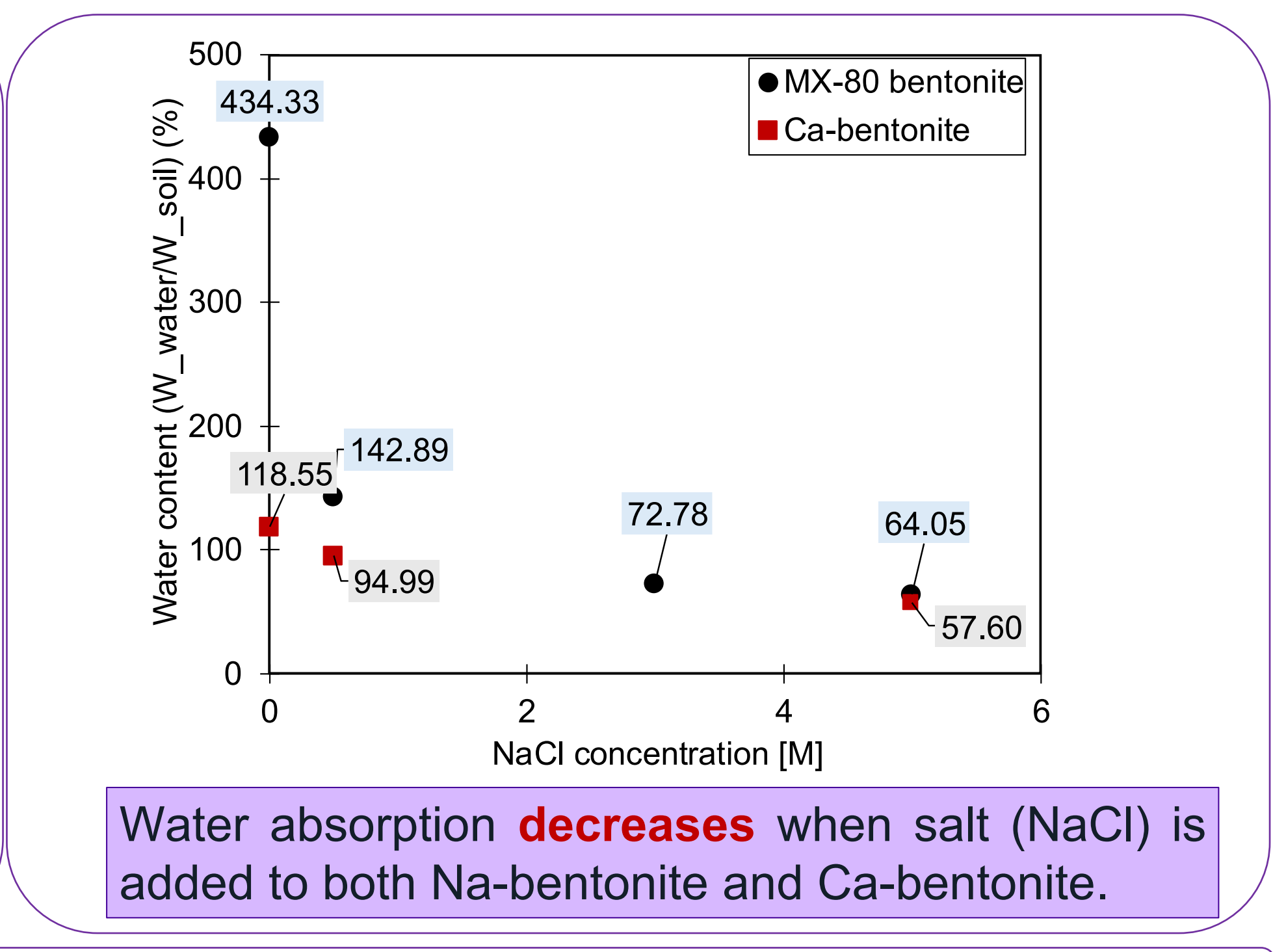
### 1.3. Research Question

- Characterization of bentonite hydro-chemo-mechano behaviour in saline environment:
  - stress-strain relation
  - water retention
  - chemical reversibility
- Macro and Micro mechanisms underlying bentonite wetting in saline environment
- Proof of concept of bentonite EBS in saline environment

## 2. Effect of Salinity on Swelling Mechanism

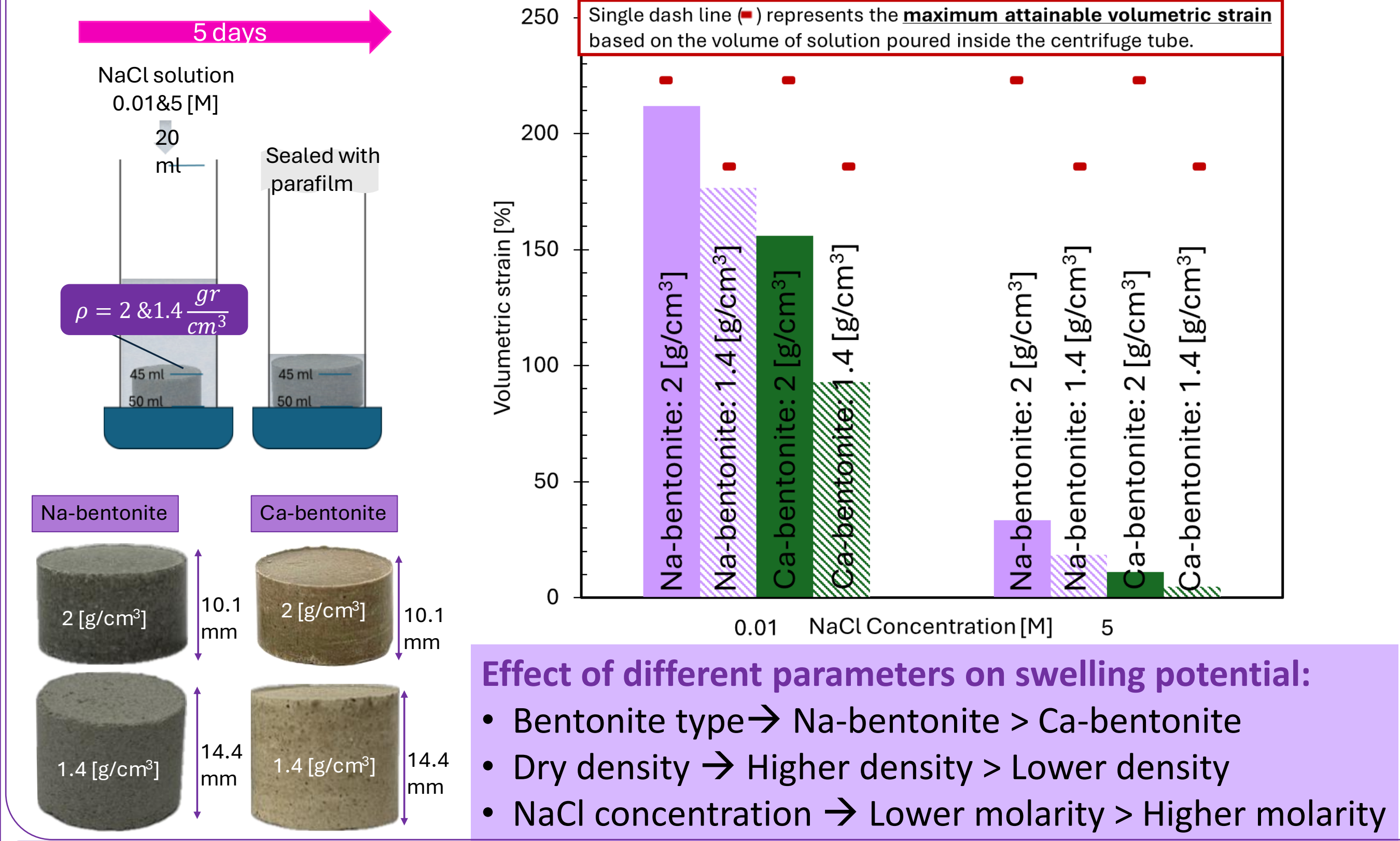


## 3. Effect of Salinity on Liquid Limit

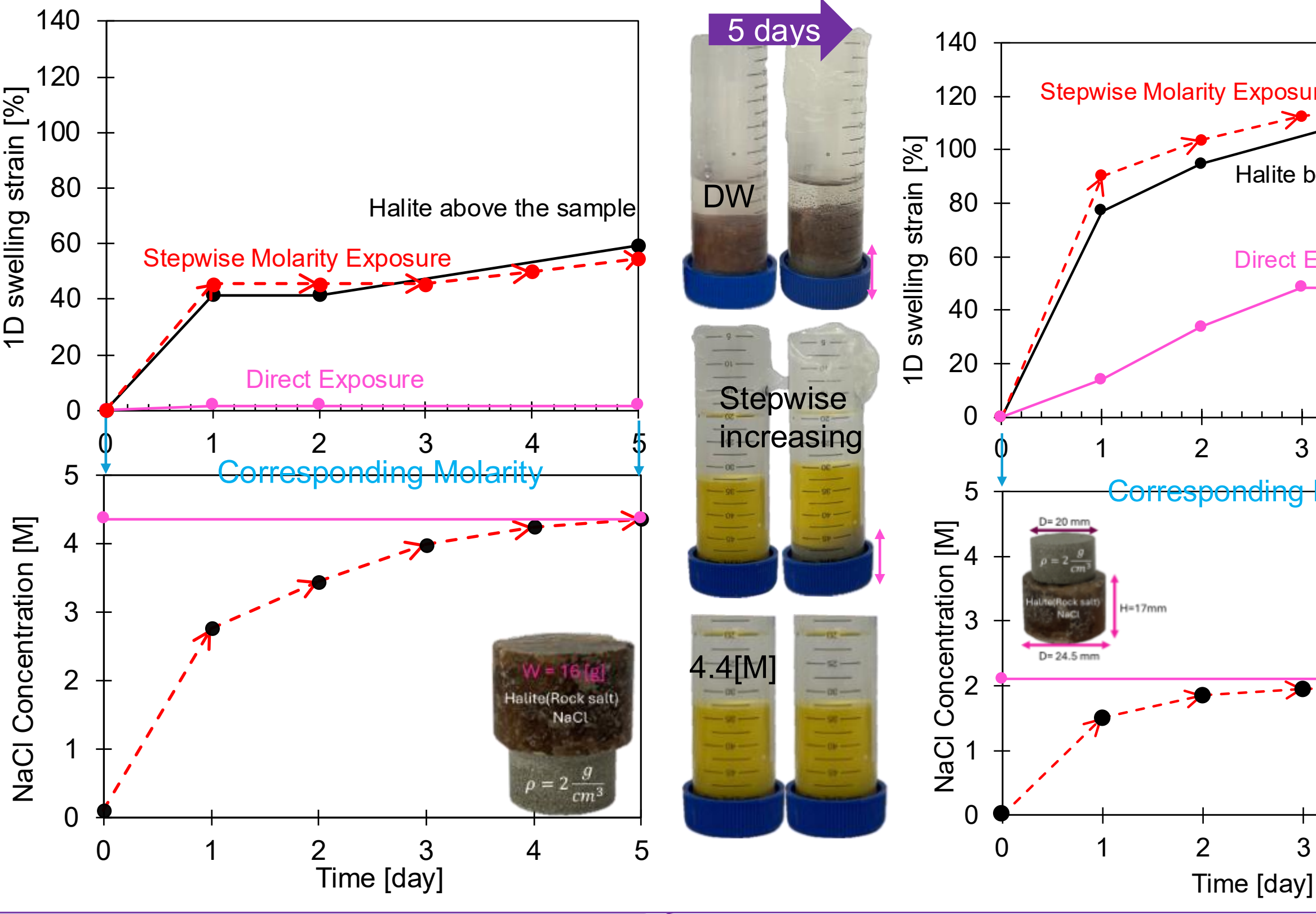


## 4. Effect of Salinity on Free Swelling test

### 4.1. Compacted bentonite: Wetting at different NaCl concentration

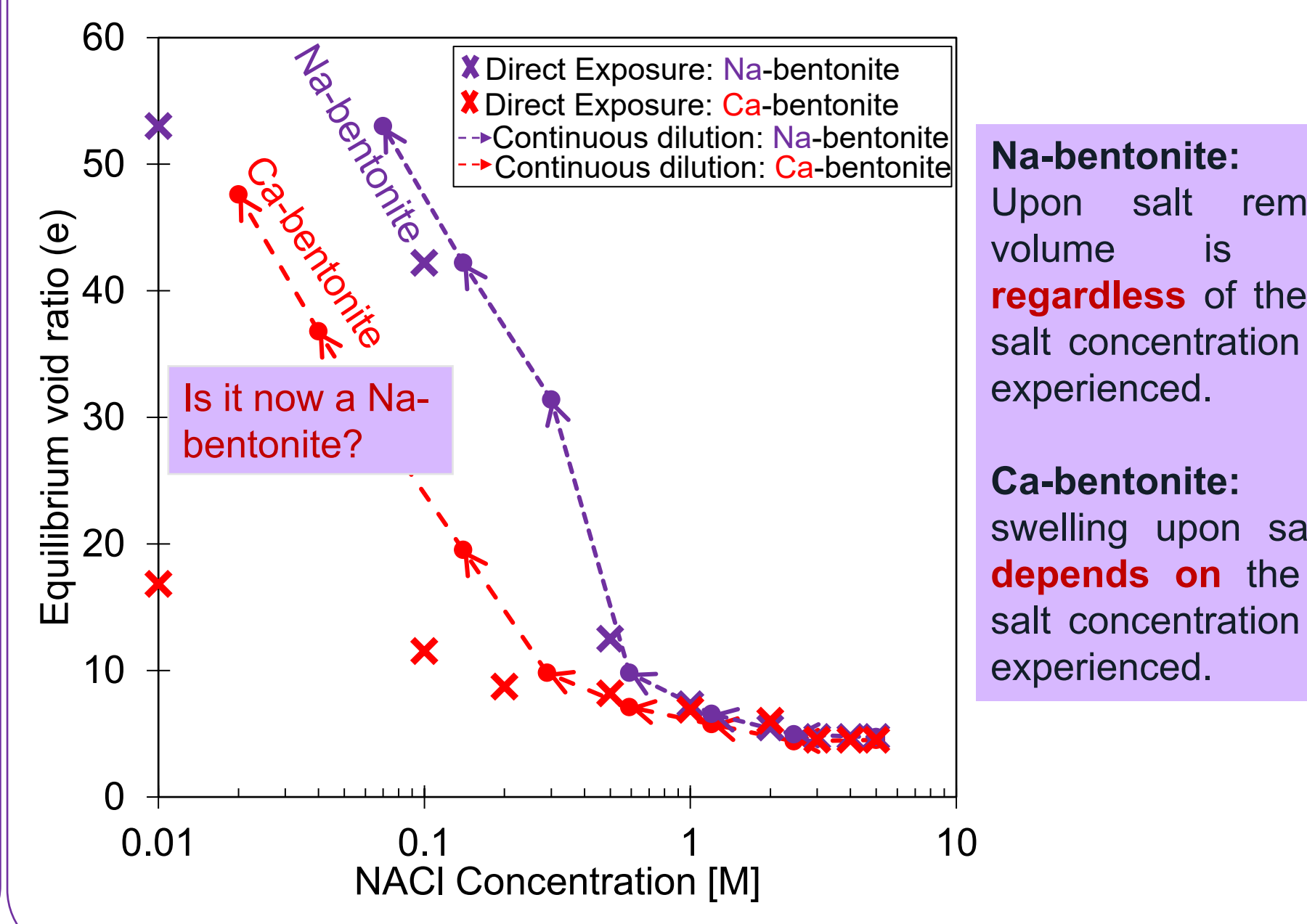


### 4.2. Interaction between compacted bentonite and halite

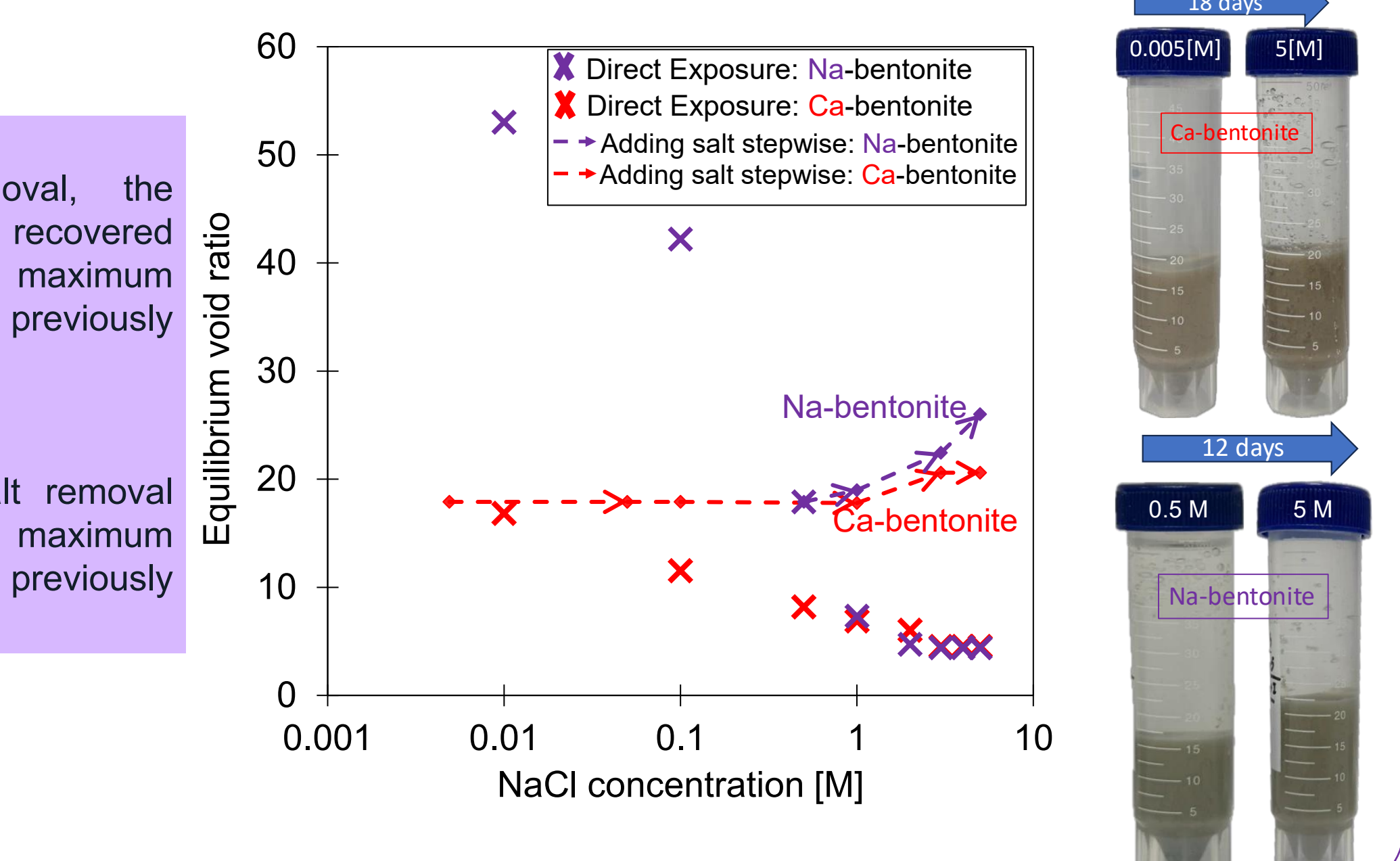


## 5. Effect of Salinity on Sedimentation behaviour

### 5.1. Continuous dilution (Starting from 5[M])

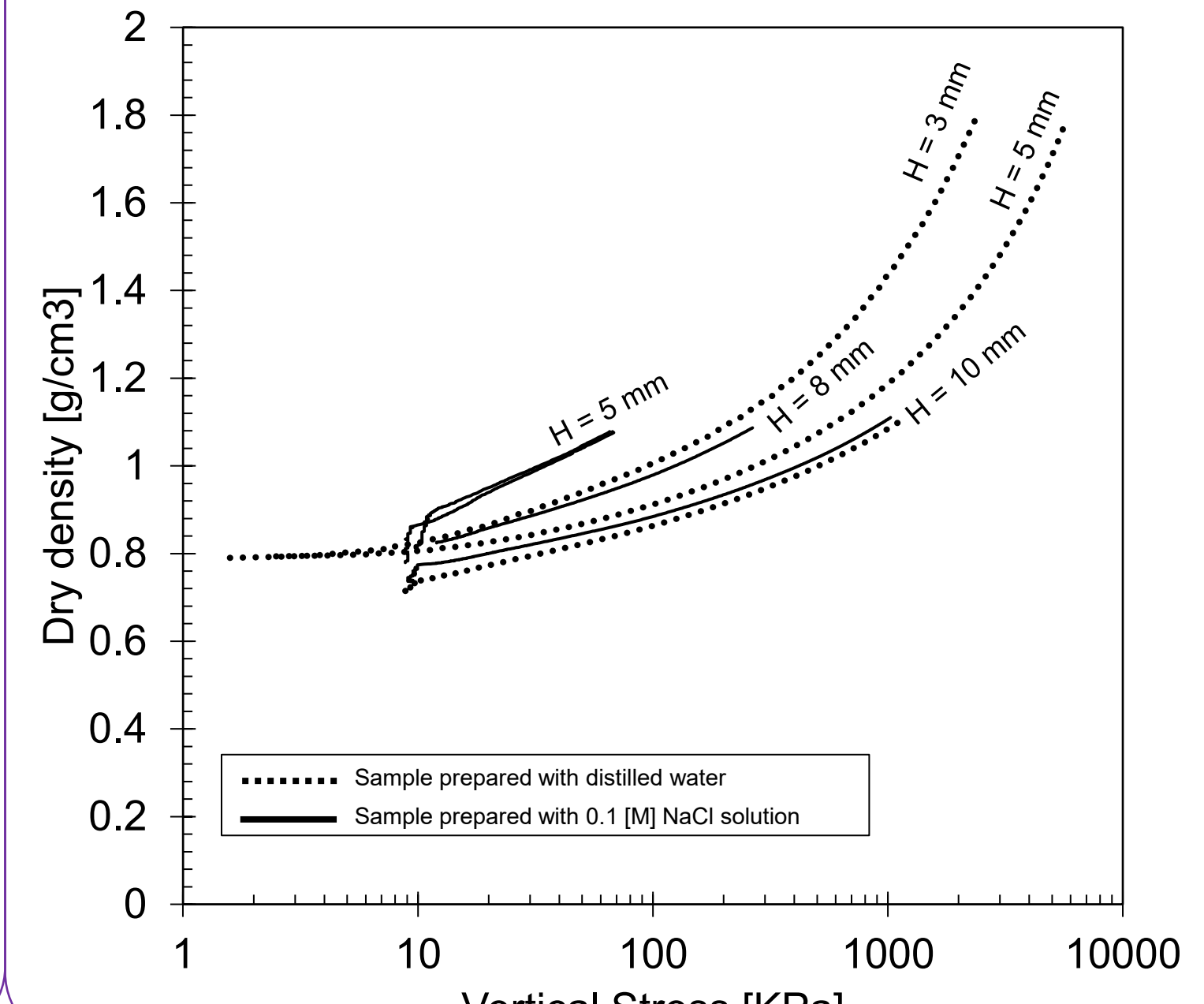


### 5.2. Increasing NaCl concentration stepwise



## 6. Sample Compaction

### 6.1. Compaction Curve (Na-bentonite)



## 6. What's next?

- Ongoing Experiments:
- Soil-water Characteristic Curve (SWCC) investigating the effect of:
    - Dry density
    - Different NaCl and CaCl<sub>2</sub> concentrations
- Future Experiments:
- Swelling pressure test
    - Wetting under constant Load
    - Wetting at constant volume